

reduced pressure condition to the atmospheric condition;

a vacuum transferring chamber coupled to said locking mechanism, for transferring said sample in a vacuum condition; and

plural vacuum processing chambers, connected to said vacuum transferring chamber, for processing said plural samples,

wherein said sample in said cassette is carried into any vacuum processing chamber, of said plural vacuum processing chambers, by way of said atmospheric transferring device, said locking mechanism, and said vacuum transferring chamber, a surface of said sample being maintained substantially horizontal while being carried into the vacuum processing chamber and processed therein, and

wherein said sample which has been processed in said vacuum processing chamber is carried out, to a cassette mounted on said cassette table, with said surface of the sample being maintained horizontal.

3. Sample processing apparatus according to claim 2, wherein said sample which has been processed is returned to said cassette from which said sample has been transferred by said atmospheric transferring device.

4. Sample processing apparatus according to claim 3, wherein said sample which has been processed is returned to the original position of said cassette from which said sample has been transferred by said atmospheric transferring device.

5.4 Sample processing apparatus, comprising:

a cassette table exposed to a cassette-transferring atmosphere, for mounting a cassette to store plural samples,

an atmospheric transferring device for transferring a sample in said cassette in an atmospheric condition, said cassette being mounted on said cassette table;

a load locking mechanism for changing over from the atmospheric condition to a reduced pressure condition as compared to the atmospheric condition;

a vacuum transferring chamber coupled to said load locking mechanism under the reduced pressure condition, for transferring said sample from said load locking mechanism to at least one of plural vacuum processing chambers connected to said vacuum transferring chamber, for processing said plural samples; and

an unload locking mechanism for changing over the reduced pressure condition to the atmospheric condition, said unload locking mechanism receiving under the reduced pressure condition the sample which has been processed in said at least one of plural vacuum processing chambers from said vacuum transferring chamber and supplying the sample, which has been processed, under the atmospheric condition to said cassette on said cassette table,

wherein said sample in said cassette is carried into any vacuum processing chamber, of said plural vacuum processing chambers, by way of said atmospheric transferring device, said load locking mechanism, and said vacuum transferring chamber, a surface of said sample being

maintained substantially horizontal while being carried into the vacuum processing chamber and processed therein, and

wherein said sample which has been processed in said vacuum processing chamber is carried out, to said cassette mounted on said cassette table, by way of said vacuum transferring chamber, said unload locking mechanism, and said atmospheric transferring device, while said surface of the sample is maintained horizontal.

4.5 Apparatus for treating at least one wafer by processing in at least one of a plurality of vacuum processing chambers, comprising:

(i) a cassette table exposed to the air, on which is placed a cassette containing at least one wafer to be processed, with a surface of the at least one wafer being horizontal;

(ii) a loading mechanism for loading said at least one wafer sequentially in order from said cassette by means including a first conveyor, a locking mechanism, and a second conveyor in a transfer chamber under vacuum, into said at least one of the plurality of vacuum processing chambers connected to said transfer chamber, said loading mechanism loading said at least one wafer into said at least one of said vacuum processing chambers such that said surface to be processed is horizontal when processed in the vacuum processing chamber; and

(iii) an unloading mechanism for unloading processed wafers sequentially in order from said vacuum processing

chamber into said cassette on said cassette table, by means including said second conveyor in said transfer chamber under vacuum, said locking mechanism, and said first conveyor.

7.6 A method of transferring a sample, using a cassette table for mounting a cassette, said cassette table being exposed to a cassette-transferring atmosphere, the method comprising the steps of:

carrying in said samples in said cassette which is mounted on said cassette table, to a locking mechanism in an atmospheric condition by use of an atmospheric transferring device;

changing over said locking mechanism from the atmospheric condition to a reduced pressure condition as compared to the atmospheric condition;

carrying in, one by one, said samples in said locking mechanism to a transferring chamber, by use of a vacuum transferring device which is installed in said transferring chamber;

processing, one by one, said samples carried into said transferring chamber, in a vacuum processing chamber of plural vacuum processing chambers;

carrying out samples processed in said vacuum processing chamber, to said locking mechanism in the reduced pressure condition, by use of said vacuum transferring device;

changing over said locking mechanism from the reduced pressure condition to the atmospheric condition; and

carrying out, said samples in said locking

mechanism, to said cassette mounted on said cassette table, by use of said atmospheric transferring device, wherein, during a time that said samples are carried, and during a processing time of said samples, a same surface of the samples is maintained substantially horizontal.

8.7 A wafer surface processing system, comprising:

a cassette table for mounting a cassette, said cassette table being exposed to a cassette-transferring atmosphere;

a plurality of surface processing chambers, each having a gate, that are arrayed about a spatial locus in such a way that the gates are accessible from a single location spaced from said gates, for processing a surface of a wafer provided in each surface processing chamber, each of the plurality of surface processing chambers having a wafer support such that said surface of the wafer is horizontal when the surface is being processed in the surface processing chamber;

a pair of wafer holding chambers spaced from the plural processing chambers along the spatial locus, for temporarily holding said wafer therein, one of said wafer holding chambers having a gate through which said wafer to be processed is transferred out of the one wafer holding chamber, the other of said wafer holding chambers having a gate through which said wafer which has been processed is transferred into the other wafer holding chamber; and

a first wafer transfer structure rotatably fixed at

said single location, for transferring said wafer through said gates of said processing and holding chambers.

9.8 The wafer surface processing system according to claim 8, further comprising a structure to provide a vacuum in each of the surface processing chambers during processing.

10.9 The wafer surface processing system according to claim 8, wherein each of said wafer holding chambers and said first wafer transfer structure includes wafer support structure such that the surface of the wafer is held horizontal by the wafer support structure.

11.10 A wafer surface processing system comprising:  
a cassette table for mounting a cassette, said cassette table being exposed to a cassette-transferring atmosphere;

a plurality of surface processing chamber structures, each having a gate, that are arrayed about a spatial locus in such a way that said gates are accessible from a single location spaced from the gates, for processing a surface of a wafer provided in the plurality of surface processing chamber structures, each of the plurality of surface processing chamber structures having a wafer support such that said surface of the wafer is horizontal when the surface is being processed in a surface processing chamber structure, of the plurality of surface processing chamber structures;

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a surface non-processing chamber structure spaced from the plurality of surface processing chamber structures along the same spatial locus and having first and second gates, for temporarily holding said wafer therein, said wafer to be processed being transferred into the surface non-processing chamber structure from outside thereof through said first gate and further transferred to one of said surface processing chamber structures through said second gate, and said wafer having been processed in any of said surface processing chamber structures being transferred from the surface processing chamber structure in which the wafer had been processed, through said second gate into the surface non-processing chamber structure and further transferred outside thereof through said first gate.

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12. A wafer surface processing system, comprising:  
a cassette table for mounting a cassette, said cassette table being exposed to a cassette-transferring atmosphere;

a plurality of surface processing chambers, each having a gate, that are arrayed about a spatial locus in such a way that the gates thereof are accessible from a single location spaced from the gates, for processing a surface of a wafer provided in a surface processing chamber of the plurality of surface processing chambers, the plurality of surface processing chambers having wafer supports such that said surface of the wafer is horizontal when the surface is being processed in the surface processing chamber;

a wafer buffering structure spaced from the plural surface processing chambers along the spatial locus and having first and second gates, for temporarily holding said wafer therein;

a first wafer transfer structure rotatably fixed at said single location, for transferring a wafer between said buffering structure and the plurality of surface processing chambers, through said gates of said surface processing chambers and said first gate of said wafer buffering structure; and

a second wafer transfer structure for transferring said wafer through said second gate of said wafer buffer structure, between said cassette and said wafer buffering structure.

13. <sup>12</sup> A wafer surface processing system, comprising:

a cassette table for mounting a cassette, said cassette table being exposed to a cassette-transferring atmosphere;

a plurality of surface processing chambers arrayed about a spatial locus in such a way that said processing chambers are accessible from a single location spaced from said processing chambers, for processing a surface of a wafer provided in a surface processing chamber of the plurality of surface processing chambers, each of the plurality of surface processing chambers having a wafer support such that said surface of the wafer is horizontal when the surface is being processed in the surface processing chamber;



first and second buffer chambers for holding said wafer therein without processing said surface of said wafer; and

a first wafer transfer structure for selectively transferring said wafer between two chambers, of all said surface processing chambers and said buffer chambers; and

a second wafer transfer structure for transferring said wafer between a cassette disposed outside said spatial locus, under an atmospheric condition, and at least one of said first and second buffer chambers.

14. <sup>13</sup> A wafer surface processing system, comprising:

a plurality of processing structures, arrayed about a spatial locus in such a way that said processing structures are accessible from a single location spaced from said processing structures, for processing a surface of a wafer provided in a processing structure of the plurality of processing structures;

a buffer structure along said spatial locus, for holding said wafer therein without processing said surface of said wafer;

a first wafer transfer structure for selectively transferring said wafer between two of said processing and buffer structures;

a second wafer transfer structure arranged between said buffer structure and a cassette disposed at a location outside said spatial locus and opposed to said buffer structure, for transferring said wafer between said cassette

and said buffer structure; and

a cassette transfer structure for transferring said cassette and positioning it at said location.

13 14 16. A wafer surface processing system according to claim 14, wherein the plurality of processing structures have wafer supports such that said surface of the wafer is horizontal when the surface is being processing in said processing structure.

16.15 A wafer surface processing system, comprising:  
a plurality of processing chambers arrayed about a spatial locus in such a way that said processing chambers are accessible from a single location spaced from said processing chambers, for processing a surface of a wafer provided in a processing chamber of the plurality of processing chambers, the plurality of processing chambers having wafer supports such that said surface of the wafer is horizontal when the surface is being processed in the processing chamber;

first and second buffer chambers along the spatial locus, for holding said wafer therein without processing said surface of said wafer;

a first wafer transfer structure for selectively transferring said wafer between two chambers, of all said processing and buffer chambers;

a second wafer transfer structure arranged between at least one of said first and second buffer chambers and a cassette disposed at a location outside said spatial locus and

opposed to said at least one of said first and second buffer chambers, for transferring said wafer between said cassette and said at least one of said first and second buffer chambers; and

a cassette transfer structure for transferring and positioning said cassette at said location.

17. A method of transferring a sample, comprising the steps of:

carrying in samples from a sample holder which is supported by a support and which is in a first atmosphere, to a locking mechanism in an atmospheric condition, by use of an atmospheric transferring device;

changing over said locking mechanism from the atmospheric condition to a reduced pressure condition as compared to the atmospheric condition;

carrying in, one by one, said samples in said locking mechanism to a transferring structure, by use of a transferring device which is located at said transferring structure;

processing, one by one, said samples carried into said transferring structure, in a processing device of plural processing devices, the plural processing devices being positioned around the transferring structure;

carrying out, one by one, samples processed in said processing device, to said locking mechanism in the reduced pressure condition, by use of said transferring device;

changing over said locking mechanism from the

reduced pressure condition to the atmospheric condition; and  
carrying out said samples in said locking mechanism,  
to a sample holder supported by a support, by use of said  
atmospheric transferring device,

wherein, during a processing time of said samples, a  
surface of each sample being processed is maintained  
substantially horizontal.

18.17 Apparatus for transferring a sample, comprising:

a sample holder for holding a sample, said sample  
holder being exposed to a transferring atmosphere, said sample  
holder being supported by a support;

an atmospheric transferring device for transferring  
a sample in said sample holder exposed to said transferring  
atmosphere;

a locking mechanism for changing over from an  
atmospheric condition to a reduced pressure condition as  
compared to the atmospheric condition, or changing over the  
reduced pressure condition to the atmospheric condition;

a transferring structure in communication with said  
locking mechanism and to which said sample is transferred;

a second transferring device located at said  
transferring structure and for transferring said sample; and

plural processing devices connected to said  
transferring structure and for processing said plural samples  
under reduced pressure conditions,

wherein said sample in said sample holder is carried  
into any processing device, of said plural processing devices,

by way of said atmospheric transferring device, said locking mechanism, and said second transferring device located at said transferring structure,

wherein a surface, of said sample, being processed is maintained substantially horizontal while being processed in the processing device, and

wherein said sample which has been processed in said processing device is carried out, to a sample holder supported by said support, by way of said second transferring device, said locking mechanism, and said atmospheric transferring device.

19. <sup>14</sup> A method of operating a wafer transfer system for reduced pressure processing devices, comprising:

an atmospheric loading step for transferring a wafer, stored with a surface thereof, to be processed in one of the reduced pressure processing devices, horizontal in a wafer holder placed at a supporting position, to a locking mechanism under atmospheric condition;

a reduced pressure loading step for transferring said wafer to said reduced pressure processing device from said locking mechanism under a reduced pressure condition as compared to the atmospheric condition;

a processing step for processing said wafer in said reduced pressure processing device with said surface being horizontal;

an unloading step for transferring said wafer from said reduced pressure processing device to said locking

mechanism under the reduced pressure condition; and

an atmospheric unloading step for transferring said wafer from said locking mechanism under the atmospheric condition to said wafer holder and storing said wafer with its surface horizontal in said wafer holder.

20. <sup>19</sup> A method of treating at least one wafer under reduced pressure processing conditions, comprising the steps of:

(i) placing a wafer holder, containing at least one wafer, at a support, exposed to first atmospheric conditions:

(ii) loading said at least one wafer from said wafer holder by means including a first conveyor, a locking mechanism, and a second conveyor in a transfer structure under reduced pressure conditions, into at least one of a plurality of reduced pressure processing devices in communication with said transfer structure, said reduced pressure conditions being a reduced pressure as compared to the first atmospheric conditions;

(iii) processing under reduced pressure conditions said at least one wafer in said at least one of the plurality of reduced pressure processing devices, with a surface of the at least one wafer, to be processed, being horizontal; and

(iv) unloading processed wafers from said reduced pressure processing chambers into said wafer holder at said support, by means including said second conveyor in said transfer structure under reduced pressure, said locking mechanism, and said first conveyor.

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21. A wafer transfer system for multi-device configuration, comprising:

a plurality of processing devices positioned around a periphery of a structure in such a way that said processing devices are accessible from a single location spaced from said processing devices, for processing a surface of a wafer provided in a processing device of the plurality of processing devices, each of the plurality of processing devices having a wafer support such that said surface of the wafer is horizontal when the surface is being processed in the processing device;

first and second buffer zones along the periphery of the structure, for holding said wafer therein without processing the surface of the wafer therein; and

a wafer transfer structure for transferring said wafer between two of said devices and zones.

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22. A wafer transfer system for multi-device configuration, comprising:

a cassette table for mounting a cassette in an atmosphere;

a plurality of processing devices positioned around a periphery of a structure in such a way that said processing devices are accessible from a single location spaced from said processing devices, for processing a surface of a wafer provided in a processing device of the plurality of processing devices, each of the plurality of processing devices having a

wafer support such that said surface of the wafer is horizontal when the surface is being processed in the processing device;

first and second buffer zones along the periphery of the structure, for holding said wafer therein without processing the surface of the wafer therein;

a wafer transfer structure for selectively transferring said wafer between two of said devices and zones; and

another wafer transfer structure for transferring said wafer between said cassette and one of said buffer zones.

23 <sup>22</sup> Apparatus for a wafer transfer system for a processing device for processing a wafer under reduced pressure conditions, comprising:

a first transfer mechanism connected to said processing device at one side of the processing device, for transferring said wafer into, and out of, said processing device, said surface to be processed being horizontal when transferred into, and out of, said processing device, and such that said surface is horizontal when processed in the processing device;

a locking mechanism having a reduced pressure side in communication with said first transfer mechanism and having an atmospheric side, for transferring said wafer between said reduced pressure side and said atmospheric side, transfer of said wafer into the locking mechanism being performed under both reduced pressure and atmospheric conditions; and



an atmospheric transfer mechanism, connected between the atmospheric side of said locking mechanism and a wafer holder, for transferring said wafer between said wafer holder and said locking mechanism,

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said locking mechanism being connected to said first transfer mechanism and disconnected from said atmospheric transfer mechanism when said locking mechanism is under reduced pressure conditions, and is disconnected from said first transfer mechanism and connected to said atmospheric transfer mechanism when said locking mechanism is under atmospheric conditions, wherein said locking mechanism has openings on both sides thereof connected to the first transfer mechanism and the atmospheric transfer mechanisms.

24-22 A method of transferring a sample, comprising the steps of:

carrying in samples, from a position of a sample holder which is supported by a support and which is in a first atmosphere, to a locking mechanism in an atmospheric condition, by use of an atmospheric transferring device;

changing over said locking mechanism from the atmospheric condition to a reduced pressure condition as compared to the atmospheric condition;

carrying in, one by one, said samples in said locking mechanism, to a transferring structure, by use of a transferring device which is located at said transferring structure;

processing, one by one, said samples carried into

said transferring structure, in a processing device of plural processing devices, the plural processing devices being positioned around the transferring structure;

carrying out, one by one, samples processed in said processing device, to said locking mechanism in the reduced pressure condition, by use of said transferring device;

changing over said locking mechanism from the reduced pressure condition to the atmospheric condition; and

carrying out said samples in said locking mechanism, to a sample holder supported by a support, by use of an atmospheric transferring device,

wherein said samples are carried out from said locking mechanism to the original position of the sample holder, and

wherein, during a processing time of said samples, a surface of each sample being processed is maintained substantially horizontal.

25. Apparatus for transferring a sample, comprising:

a sample holder for holding a sample in a position, said sample holder being exposed to a transferring atmosphere, said sample holder being supported by a support;

at least one atmospheric transferring device for transferring a sample in said sample holder exposed to said transferring atmosphere;

a locking mechanism for changing over from an atmospheric condition to a reduced pressure condition as compared to the atmospheric condition, or changing over the

reduced pressure condition to the atmospheric condition;

a transferring structure in communication with said locking mechanism and to which said sample is transferred;

a second transferring device located at said transferring structure and for transferring said sample in said reduced pressure condition; and

plural processing devices connected to said transferring structure and for processing said plural samples under reduced pressure conditions,

wherein said sample in said sample holder is carried into any processing device, of said plural processing devices, by way of said at least one atmospheric transferring device, said locking mechanism, and said second transferring device located at said transferring structure,

wherein a surface of said sample being processed is maintained substantially horizontal while being processed in the processing device, and

wherein said sample which has been processed in said processing device is carried out to the original position of a sample holder supported by a support, by way of said second transferring device which is located at said transferring structure, said locking mechanism, and said atmospheric transferring device.

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26. A method of treating at least one wafer under reduced pressure processing conditions, comprising the steps of:

- (i) placing a wafer holder, containing at least one

wafer in each position thereof, at a support, exposed to first atmospheric conditions;

(ii) loading said at least one wafer from said wafer holder by means including at least one first conveyor, a locking mechanism, and a second conveyor in a transfer structure under reduced pressure conditions, into at least one of a plurality of reduced pressure processing devices in communication with said transfer structure, said reduced pressure conditions being a reduced pressure as compared to the first atmospheric conditions,

(iii) processing under reduced pressure conditions said at least one wafer in said at least one of the plurality of reduced pressure processing devices, with a surface of the at least one wafer, to be processed, being horizontal; and

(iv) unloading processed wafers from said reduced pressure processing chambers to each original position in the wafer holder, by means including said second conveyor in said transfer structure under reduced pressure, said locking mechanism, and said at least one first conveyor.--

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